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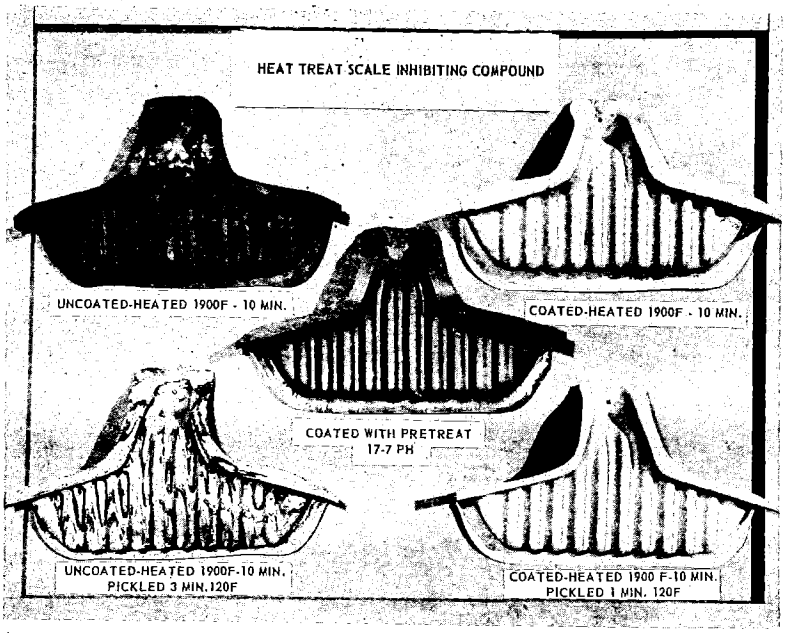
TECHNICAL

DATA

BULLETIN NO. 35

TURCO PRODUCTS • A DIVISION OF PUREX CORPORATION, LTD. • WILMINGTON, CALIFORNIA 90744 • OFFICES IN ALL PRINCIPAL CITIES

TURCO® PRETREAT



THE NEW PROCESS THAT MAKES DESCALING OF HIGH-TEMP CORROSION-RESISTANT ALLOYS -- QUICK! THOROUGH!

INEXPENSIVE!

IDEAL FOR **STAINLESS STEELS; TITANIUM ALLOYS; NICKEL ALLOYS** AND OTHER HIGH-STRENGTH, HIGH-TEMPERATURE ALLOYS; NON-FERROUS ALLOYS

Turco Pretreat is a versatile material which, when properly used, will inhibit the formation of tenacious scales formed in heat treatments on such metals as stainless steels, nickel chrome alloys, alloys of cobalt, titanium and copper.

There are many adequate descaling procedures available today; however, they are expensive, time-consuming, and many are unnecessarily detrimental to the metal.

The Turco Pretreat process is so effective that it minimizes the need for expensive inert gas atmosphere furnaces and the extremely corrosive acid mixtures commonly used for descaling these alloys.

Pretreat not only makes the descaling operation easier when properly used, but also reduces intergranular oxidation. As a pre-heat-treatment Pretreat inhibits the formation of adherent oxides and allows the use of mild acid descaling solutions. After heat treatment, the Pretreat compound and the conditioned scale are easily removed by the **Turco** descaling solution.

This process has been found beneficial in minimizing decarburization of those stainless steels on which decarburization is a problem. The use of Turco Pretreat on heat-treatable alloys reduces high-temperature oxidation which normally occurs at grain boundaries during heat treating and the subsequent inter-granular attack during the acid descaling cycle.

BENEFITS OF TURCO PROCESS

When Turco Pretreat is properly used prior to heat treating, the following benefits will be obtained:

1. Shortened descaling time, due to ease of oxide removal.
2. Very low metal loss (approximately 0.0002" per side).
3. Chemical cleanliness.
4. Minimum equipment requirements.
5. Minimum inter-granular attack and surface notching.

HOW TO USE THE TURCO DESCALING PROCESS

Precleaning

1. Proper precleaning is essential. Many soils, if not completely cleaned from the metal surface prior to heat treatment, can have very deleterious effects on metal alloys during the heat treat process. Undesirable alloying with the metal surfaces, often accompanied by pitting and other serious defects, can result from failure to preclean in accordance with recommended procedures.

   Thorough cleaning should be accomplished with Turco HTC, Vitro-Klene, Petro-Klene, or other suitable Turco cleaner. Normal use conditions are 6 to 8 ounces per gallon of water, 180-200°F., 10 to 15 minutes. Further information on these products may be found in the Technical Data Bulletins available from Turco Products, Inc.

2. Rinse with overflowing water (warm preferred), for the time required to obtain a thoroughly clean, water-break-free surface.

3. Acid clean in appropriate descaling solution for 5 to 10 minutes. (See Appendix for composition.) Acid cleaning is not necessary for all conditions, but it is essential where dye contaminants such as lead and zinc, not removable in alkaline precleaning, are known or suspected to be present on the metal surfaces.

4. Rinse with overflowing water, 2 to 3 minutes.

5. Allow parts to dry.

Application of Turco Pretreat

1. After thorough cleaning and drying, apply Turco Pretreat compound as soon as possible to prevent recontamination of metal surfaces.

2. Pretreat must be thoroughly mixed before using. The best method for obtaining the very thin protective coating of Pretreat is to apply by spray. Small amounts of toluene may be added to adjust the viscosity to proper spraying consistency. Normal paint spraying equipment is satisfactory for application of the thin coating necessary for protection. Spraying equipment recommended is a Binks Model #7 Spray Gun equipped with #36SD Tip, or equivalent equipment from other manufacturers. Spray pressure of 35# per square inch has been found satisfactory.

   For dip application, a special version of Pretreat is available. If Pretreat is applied by dip, special precautions must be taken to avoid coating thicknesses in excess of those recommended.

3. Whether Pretreat is applied by spray or dip, coating thickness must not exceed 0.2 to 0.3 mils. in any location on the part. Special caution must be taken in applying Pretreat to corners or other irregular surfaces. Normally the application of a thin box coating until a uniform light orange-gold coating color appears on the surface is sufficient to obtain the recommended thickness.

It is essential that film thickness in excess of 0.3 mils. of Turco Pretreat be avoided. Besides being wasteful of material, heavy coatings can interfere with the proper performance of Turco Pretreat. This is especially important if furnace atmosphere is not very carefully controlled to be slightly oxidizing.

4. Under normal atmospheric conditions, drying time is 1 to 5 minutes, after which time the Pretreat film is normally resistant to scuffing and finger-printing. Should it become necessary to remove Pretreat from the metallic surfaces prior to heat treating, immersion in the Turco alkaline cleaning solution for 10 to 15 minutes will suffice.

5. Pretreated parts must be racked in the heat treat furnace to allow free circulation of air around each part in order to properly cure the Pretreat coating. Furnace atmosphere must be slightly oxidizing. A reducing atmosphere must be avoided, since this prevents proper functioning of the Pretreat. Note that no pretreatment material will protect against dirty furnace conditions.

Removing Thermal Oxides

1. Immerse parts in appropriate Turco scale removing solution. (See Appendix for choice of proper descaling solution. In some cases the use of a special scale conditioning step, as outlined in the appropriate Appendix Section, may be required prior to immersion in the scale removing solution.)

2. Rinse in cold, overflowing water, 2 to 3 minutes.

3. Pressure spray rinse with Turco Air & Water Rinser to remove lightly adhering oxides which remain on the metal surfaces.

ADDITIONAL USES FOR TURCO PRETREAT

As a lubricant for hot forming of sheet titanium, hot flaring of titanium tubing, cold forming of 17-7PH plate steel.

As a coating on carbon steel dies used in hot sizing operations. Prevents scale build-up.

As a rust preventive on carbon steels to be stored.

As a protective coating on copper and copper alloys for annealing.

RECOMMENDED PROCEDURE FOR EVALUATION OF TURCO PRETREAT

It is impossible to cover all variations in oven atmospheres and metallurgical properties in this Technical Data Bulletin. In order to insure that our customers obtain the full benefits of the Turco Pretreat Process, we recommend that prior to actual production use, Turco Pretreat be applied to experimental surfaces and heat treated in the scheduled manner. Parts selected for such experimental evaluation should be typical of the production parts to be processed, in order that all surface condition variables may be covered.

CAUTION: Flammable material. Keep away from heat and open flames. Avoid prolonged breathing of vapor. Use with adequate ventilation. Refer to product label for further precautionary and handling information.

The information and recommendations of Turco concerning these products are based upon our laboratory tests and experience and to the best of our knowledge and belief are true and accurate. Since conditions of actual use are beyond our control, any recommendations or suggestions are made without warranty, express or implied.

APPENDIX INDEX

Note

The choice of the proper solution for acid cleaning or removing thermal scale is determined by the type of alloy, the alloy constituents, and the ability of the alloy to be hardened by thermal treatment

APPENDIX A

Solution A

(When using 42° Bé nitric acid)
52 volumes of water
34 volumes of 70% (42° Bé) nitric acid
14 volumes of Nitradd (Turco 4104) Activator

(When using 38° Bé nitric acid)
44 volumes of water
42 volumes of 58% (38° Bé) nitric acid
14 volumes of Nitradd (Turco 4104) Activator

Note: Times and temperatures listed are optimum. Satisfactory results at room temperature can be obtained in most cases by extending immersion time.

Used to descale:

Stainless Steels

1. 18-8 Chrome-nickel steels: non heat-hardenable; types 301, 302, 303, 304, 305, 316, 317, 318, 321, 347, 348 (use Solution A at 70 to 85° F. for 15 to 20 minutes).

2. 19-9 Chrome-nickel alloys: non heat-hardenable; types 19-9 DL, 19-9 DX (use Solution A at 70 to 85° F. for 15 to 20 minutes).

3. 20-10 Chrome-nickel alloys: non heat-hardenable; types 308, 309, 310, 314, etc. (use Solution A at 110 to 120° F. for 20 to 30 minutes).

4. Chrome-nickel-cobalt alloys: non heat-hardenable; type N-155 (use Solution A at 110 to 120° F. for 20 to 30 minutes).

High Nickel Base Alloys

1. Chromium alloys: hardenable and non heat-hardenable; types Inconel, Inconel X, Nimonic 75, Inconel W, etc. (use Solution A at 70 to 85° F. for 15 to 25 minutes).

2. Molybdenum alloys: hardenable and non heat-hardenable; Hastelloy B, Hastelloy C, Hastelloy X, etc. (use Solution A at 110 to 120°F. for 15 to 25 minutes).

3. Cobalt alloys: non heat-hardenable types; HS-27, Rene 41, UDIMET 500, etc. (use Solution A at 110 to 120°F. for 15 to 25 minutes).

High Colbalt Base Alloys

1. Chrome-nickel alloys: hardenable and non heat-hardenable; types S-816, HS-25 (L605), etc. (use Solution A at 110 to 120° F. for 15 to 25 minutes).

APPENDIX B

Solution B

(When using 42° Bé nitric acid)
53 volumes of water
40 volumes of 70% (42° Bé) nitric acid
7 volumes of Nitradd (Turco 4104) Activator

(When using 38° Bé nitric acid)
43 volumes of water
50 volumes of 58% (38° Bé) nitric acid
7 volumes of Nitradd (Turco 4104) Activator

72 to 90° F. for 10 to 20 minutes

Used to descale:

Stainless Steel, as noted.

1. Chrome-nickel alloys: heat hardenable; types 15-7 Mo, 17-7 PH, 17-4 PH, AM 350, A-286, etc.

Note: See also Appendix E, Stainless Steels, Paragraph 2.

APPENDIX C

Solution C

(When using 42° Bé nitric acid)
47 volumes of water
47 volumes of 70% (42° Bé) nitric acid
6 volumes of Nitradd (Turco 4104) Activator

(When using 38° Bé nitric acid)
36 volumes of water
58 volumes of 58% (38° Bé) nitric acid
6 volumes of Nitradd (Turco 4104) Activator

72 to 90°F. for 10 - 20 minutes.

Used to descale:

All Titanium Alloys: hardenable and non-hardenable.

Note:

a. This bath should not be used as a common pickle for titanium and for stainless steel or other alloys. Accelerated action and pitting of titanium alloys may result.

b. When it becomes impractical to use Turco Pretreat on titanium surfaces or the Turco Pretreat coating has been destroyed, parts should be processed in accordance with Appendix D.

APPENDIX D

Solution D

To prepare 100 gallons of solution:

To 75 gallons of water, slowly add 640 lbs. of Turco 4316 Scale Conditioner*with gentle agitation. (Caution! Heat evolved). Use at 270 to 280°F.
*U.S. Pat. 2,861,015

When it becomes impractical to use Turco Pretreat on titanium surfaces or the Turco Pretreat coating has been destroyed, parts should be processed in the Turco 4316 scale conditioning bath prior to descaling. The complete cycle is as follows:

1. Immerse parts in Turco 4316 scale conditioner 10 - 15 minutes for oxides formed below 1200° F. and 40 - 45 minutes for oxides formed above 1200° F.
2. Rinse in cold overflowing water, 3 - 5 minutes.
3. Remove conditioned oxides by immersing in Solution C.
4. Rinse in cold overflowing water 3 - 5 minutes.
5. Pressure spray rinse with Turco Air-and-Water Rinser to remove lightly adhering oxides.

It should also be noted that the use of Turco 4316 conditioning bath in conjunction with Turco Pretreat pretreatment, greatly facilitates the descaling of oxides encountered above 1400° F.

Note: Refer to Technical Data Bulletin #314 for detailed use instructions on Turco 4316 Scale Conditioner.

APPENDIX E

Solution E

(When using 42° Bé nitric acid)
69 volumes of water
15 volumes of 85% phosphoric acid
10 volumes 70% (42° Bé) nitric acid
6 volumes Nitradd (Turco 4104) Activator

(When using 38° Bé nitric acid)
66 volumes of water
15 volumes of 85% phosphoric acid
13 volumes of 58% (38° Bé) nitric acid
6 volumes Nitradd (Turco 4104) Activator

Note: Time and temperatures listed are optimum. Satisfactory results at room temperature can be obtained in most cases by extending immersion time.

Used to descale:

Stainless Steels, as noted:

1. High Chrome alloys: hardenable and non-hardenable; 400 series steels (use at 110 to 120° F. for 15 to 25 minutes).
2. This solution is also recommended for Chrome-nickel precipitation hardenable steel alloys, such as 15-7 Mo, 17-7 PH, AM 350, etc. where minimum metal loss is desired and facilities are available for heating the solution.

Nickel Alloys, as noted:

1. 98% plus nickel: use at 110 to 120° F. for 10-20 minutes.
2. Copper alloys: Monel, K Monel, R Monel, K-R Monel, use at 110 to 120° F. for 15 - 25 minutes.

Copper Alloys

1. All alloys: use at 110 - 120° F. for 10 - 25 minutes.

APPENDIX F

Solution F

2 - 2½ pounds of Turco 4338 Scale Conditioning Compound
per gallon of water.
Use at 190°F. to 200°F. for 30 - 60 minutes.

Scale Conditioning

It is not always possible to use Turco Pretreat prior to thermal treatment and this normally results in a difficult-to-remove scale being formed. There are also cases where Pretreat is used and it is still necessary to use exceptional care in descaling. Scale conditioning will be highly beneficial in both these cases.

Uses of Scale Conditioning

Scale conditioning is used on many different grades of stainless steel, including the 300 series, 400 series, precipitation hardening grades, and higher alloys. Some of the common alloys involved are Type 321, Type 347, Type 410, Type 431, 17-7 PH, PH 15-7 Mo, and AM 350. Scale conditioning is useful on nickel and cobalt alloys as well as on most of the other high strength, high temperature corrosion-resistant alloys.

Note:

After scale conditioning in Solution F, the particular alloy is then descaled by short immersion in its corresponding descaling solution. (See preceding appendices).

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INHIBITED PICKLE

A mild descaler for use on stainless steel honeycomb core material such as PH 15-7 Mo, 17-7 PH and other heat hardenable alloys.

* HNO_3	-	7-9% volume
Turco 4104	-	6-8% volume
Water	-	Remainder

Use at room temperature or up to 100° F.

* 10 - 13% volume 42° Bé nitric acid or
12 - 16% volume 38° Bé nitric acid